

Ecosystem Restoration Study (ERS) and PEIR Approaches



March 14, 2006
SSAQWG Meeting

Approaches must be consistent with prior mitigation plans and requirements

- ⌘ **ERS alternatives all must include implementation of the mitigation and monitoring requirements of the IID Water Transfer FEIS/FEIR – the 4 Step Plan:**
1. restrict access
 2. conduct research and monitoring
 3. if emissive, provide offsets
 4. if insufficient offsets, implement feasible dust mitigation measures

Legislation requires air quality impacts be avoided to the greatest extent practicable

- ⌘ **Air Quality Management (AQM)**
incorporated into all ERS alternatives
- ⌘ **AQM approach consistent across all ERS alternatives**

AQM approach recognizes uncertainty regarding location and extent of emissive areas

- ⌘ **Monitor newly exposed playa for stability and emissivity**
- ⌘ **Transition areas deemed stable to long-term monitoring**
- ⌘ **Implement proven controls on areas that exhibit substantial risk of causing unacceptable air quality impacts**

AQM approach recognizes that more will be learned about dust control on the future playa

- ⌘ **Focused R&D Program planned**
- ⌘ **Potential dust control measures (DCMs) for eventual implementation at Salton Sea will be evaluated and, if promising, developed**
- ⌘ **Measures would be selected, planned, and deployed based on**
 - ☒ need and site-specific conditions
 - ☒ proven effectiveness
 - ☒ water and cost efficiency
 - ☒ compatibility with other program goals and constraints

AQM Planning Process for the ERS

- ⌘ **Dust Control Measures for ERS planning:**
 - ☒ Select the most cost- and water-efficient among measures proven effective for large-scale playa dust control.
 - ☒ Avoid conflict with other program goals.
 - ☒ Ensure allocation of sufficient water and capital resources for future potential AQM requirements.
- ⌘ **Build in flexibility and adaptive management.**
 - ☒ Other potential DCMs may eventually be evaluated for implementation at Salton Sea.
 - ☒ If promising, approach allows for further development and implementation.

AQM Planning Process for the ERS, continued

- ⌘ For resource (capital and water) allocation purposes, **assume implementation of irrigated control on 50% of playa area**; assume other areas either not emissive or controlled by other means.
- ⌘ Should allocated **resources prove to be in excess** of actual AQM needs, re-allocate to other program purposes (e.g., habitat).
- ⌘ Should **additional resources** be required for AQM, supplementary environmental documentation would likely be required.

Full range of potential dust control approaches evaluated relative to performance criteria

- ⌘ **Options that require water**
 - ☐ Stabilization with brine
 - ☐ Water-efficient vegetation
 - ☐ Climatic event-driven surface wetting
 - ☐ Event-driven sprinkler irrigation
 - ☐ Regular watering
 - ☐ Seasonal surface wetting
- ⌘ **Options that require minimal water**
 - ☐ Gravel blanket
 - ☐ Chemical stabilizers
 - ☐ Tillage
 - ☐ Sand fences
 - ☐ Moat and row

Planning DCMs and approximate resource allocations

⌘ General:

- ☒ Control of traffic (e.g., restrict access)
- ☒ Watering, surface treatment, and/or gravelling of roads and berms

⌘ Short-term DCMs for large areas:

- ☒ Sand trapping (fences, moat and row)
- ☒ Chemical stabilization, surface treatments

⌘ Long-term DCMs for large areas:

- ☒ Water-efficient vegetation (above brine pond high-water level)
- ☒ Stabilization with brine (below brine pond high-water level)

Order-of-magnitude costs

DCM	Owens construction costs	SS, Rough OM		Owens construction costs	SS, Rough O-M		Water		
		Low	High		Low	High	Low	High	Source
		(\$/sq mi)			(\$/acre)		(f/y)		
Gravel		\$ 12.0	\$ 21.3		\$ 18,822	\$ 33,342	0.0		
SF pond	\$ 7.0			\$ 10,938			4.2		Any
SF simple	\$ 9.0			\$ 14,063			3.6	4.2	Any
SF uniform	\$ 11.0			\$ 17,188			3.6	4.2	Any
WEV	\$ 12.0	\$ 9.0	\$ 14.5	\$ 18,750	\$ 14,063	\$ 22,585	1.0		Inflow
SWB			\$ 1.1			\$ 1,715	6.0	20.0	Any
Pallatives		\$ 0.1	\$ 31.1		\$ 233	\$ 48,564	0.003	0.04	
Owens construction Annual cost									

AQM Approach in the Ecosystem Restoration Study and PEIR

- ⌘ **Based on proven, reliable DCMs for planning (resource allocation) purposes**
- ⌘ **Leaves the door open to new knowledge and methods**
- ⌘ **Reserves adequate resources and contingencies for management of risk and avoidance of air quality impacts**

End of show

Performance criteria (detail)

Performance Criteria - Extent and Effectiveness

- ⌘ **Achieve ERS requirements and conform with applicable air quality management plans/SIPs**
- ⌘ **Focus AQM on significant sources**
- ⌘ **Effective in a timely manner**
- ⌘ **Robust in response to environmental pressures**
 - ☒ **drought and flood**
 - ☒ **fire and frost**
 - ☒ **plant pathogens**
 - ☒ **playa soils, drainage, and shallow groundwater quality**
 - ☒ **salinity, sodium, and selenium**
 - ☒ **bearing capacity**

Performance Criteria

- Extent and Effectiveness (cont)

- ⌘ **Proven for similar applications, confirmed during R&D, then monitored to verify**
- ⌘ **Adapted over time as needed to achieve goals**
- ⌘ **Refine control area through monitoring that commences upon de-watering**

Performance Criteria

- Integration with Ecosystem Restoration Goals

- ⌘ **Avoid creation of unacceptable human health and eco-toxicity risks**
- ⌘ **Avoid water quality degradation**
- ⌘ **Generate habitat or other benefits where feasible within core AQM function**

Performance Criteria

- Feasibility and Cost

- ⌘ **Phase implementation with creation of newly exposed playa areas (constructable phases)**
- ⌘ **Flexible design for adaptive management**
- ⌘ **Efficiently use water and capital**
- ⌘ **If water is required for AQM, then water supply, quality, quantity, and timing are defined and allocated in the ERS water balance for the alternative**
- ⌘ **If vegetative, an adequate supply of planting material can be developed or purchased**
- ⌘ **AQM design, construction, and operation in each phase builds on foundation of R&D and previous phases**

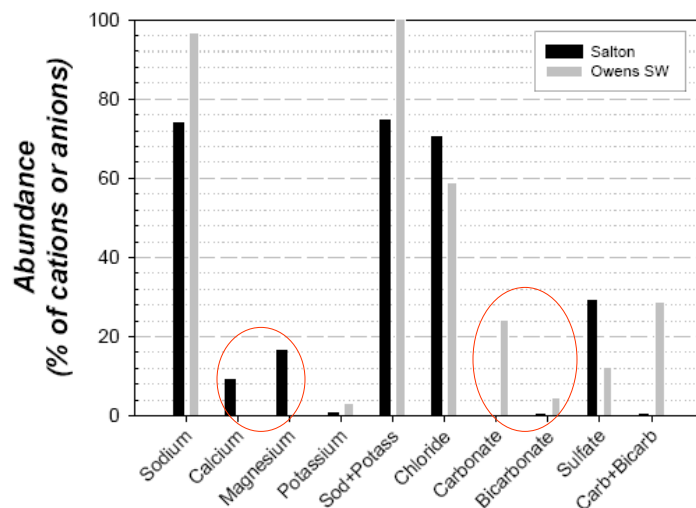


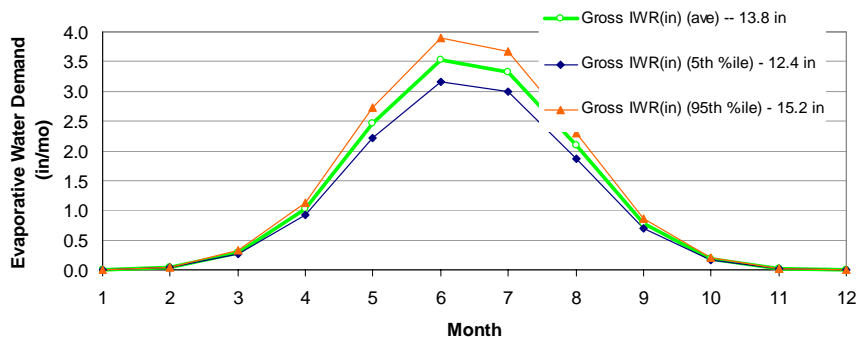
FIGURE 6

Relative Abundance of Major Cations and Anions at Salton Sea (Bertram Station, 1996-2001) and in Subsurface Drainage Water at Owens Lake (Agrarian and Tree Rows Sites, October 1998). Abundance for cations (sodium, calcium, magnesium, and potassium) is given as a percentage of the total cations, and for anions (chloride, carbonate, bicarbonate, and sulfate) as a percentage of total anions (milliequivalents/liter). Source: IID Water Conservation and Transfer Draft EIS EIR.

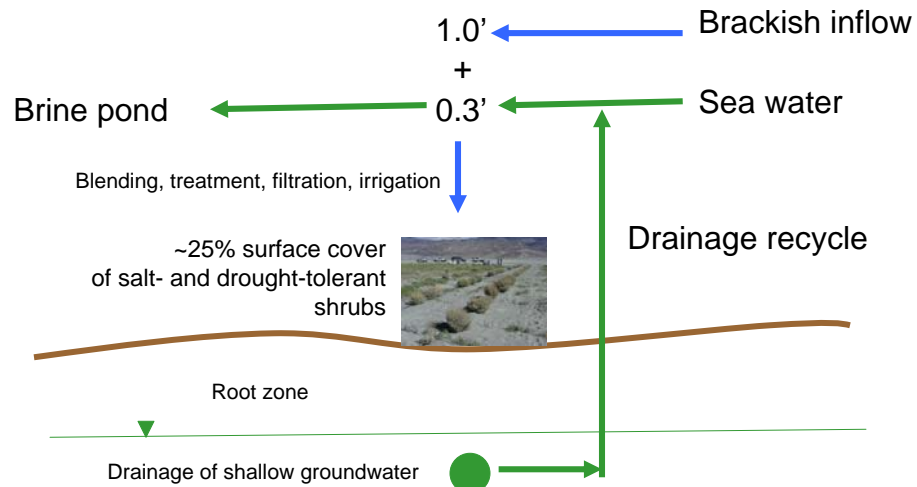
Bertram Station

Year	1995		1996		1997		1998		1999		2000		2001		
Date of Sample	10-May	26-Oct	25-Apr	31-Oct	21-Apr	16-Oct	6-May	16-Nov	5-May	1-Nov	11-May	18-Nov	18-May	30-Nov	
CATIONS															
Salton Sea															
Ca	ppm	1590	658	877	1817	823	1267	1223	875	1082	1715	981	1042	1031	1880
	cpm	79.34	32.85	43.75	90.65	41.04	63.21	61.04	43.66	53.99	85.60	48.96	51.99	51.44	93.81
	% cpm	14%	6%	8%	15%	6%	14%	8%	7%	6%	12%	7%	7%	7%	12%
Mg	ppm	1280	600	1500	1467	1100	967	2300	1110	1500	1330	1140	1530	1490	1500
	cpm	105.27	49.34	123.36	120.62	90.46	79.50	189.15	91.02	123.36	109.38	93.75	125.82	122.54	123.36
	% cpm	18%	9%	22%	20%	14%	17%	25%	14%	14%	15%	13%	17%	18%	16%
Na + K	ppm	9165	11013	9320	8970	11649	7431	11820	11677	15608	12461	13165	13468	12160	13447
	cpm	396.92	477.65	405.06	389.84	504.65	322.10	512.02	502.99	673.43	537.38	567.93	581.06	524.30	576.93
	% cpm	68%	85%	71%	65%	79%	69%	67%	79%	79%	73%	80%	77%	75%	73%
ANIONS															
HCO ₃ + CO ₃	ppm	170	180	170	180	186	182	194	198	192	186	226	208	188	202
	cpm	2.79	2.95	2.79	2.95	3.05	2.98	3.18	3.25	3.15	3.05	3.70	3.41	3.08	3.31
	% cpm	1%	1%	0%	0%	0%	1%	0%	1%	0%	0%	1%	0%	0%	0%
Cl	ppm	15695	14995	16945	17495	16494	15995	14427	17371	18494	17745	17245	17495	19143	19498
	cpm	442.60	422.86	477.84	493.36	465.14	451.06	300.36	490.00	521.54	500.39	486.30	493.35	540.00	549.84
	% cpm	74%	73%	81%	83%	69%	94%	39%	76%	64%	70%	69%	68%	75%	70%
SO ₄	ppm	7250	7100	5400	4750	9664	1185	16495	7203	13944	10245	10368	11154	8726	11360
	cpm	150.95	147.82	112.43	98.90	201.21	24.67	465.16	149.82	290.30	213.30	215.87	232.23	181.67	236.52
	% cpm	25%	26%	19%	17%	30%	5%	61%	23%	36%	30%	31%	32%	25%	30%
Total	cpm	1177.87	1133.47	1165.23	1196.32	1305.55	943.52	1530.91	1280.74	1665.77	1449.10	1416.51	1487.86	1423.03	1583.77
T.D.S.*	ppm	40546	42962	40628	40944	40515	42610	42872	42402	42978	43081	43972	42802	45509	47616
T.D.S.*	ta.f.	55.14	58.43	55.25	55.68	55.10	57.95	58.31	57.67	58.45	58.59	59.80	58.21	61.89	64.76
Conductivity		60000	75000	60000	65000	50000	48750	46000	50000	31300	70900	65600	82300	82320	84300
ph		7.80	7.80	7.80	8.10	8.00	8.50	8.50	8.20	8.04	8.06	7.04	7.92	7.99	8.18

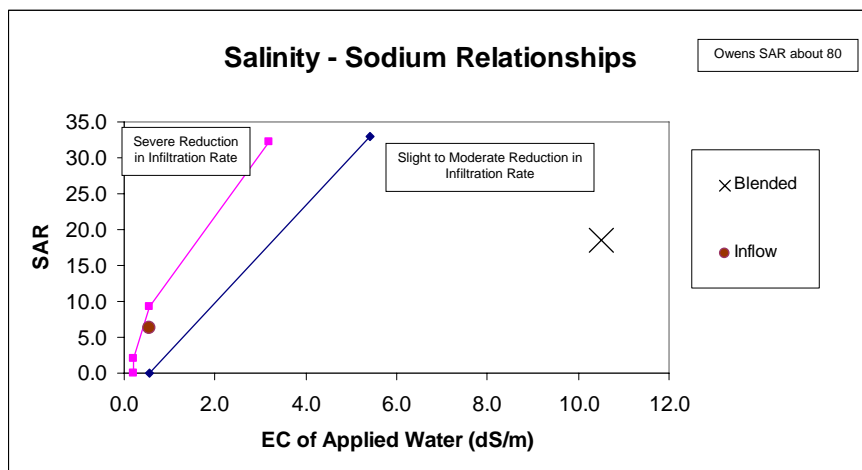
Irrigation water demand, WEV



AQM Example: Water-efficient Vegetation



Irrigation water blending



DCM	Basic Concept	Constraints, Requirements, Advantages, Effectiveness	Preliminary Finding for Large-scale Implementation at Salton Sea
Require Water			
Wetting with Brine	Spread brine to form stable salt crust	<ul style="list-style-type: none"> Uncertain crust stability Not proven effective Attractive for areas flooded seasonally by brine pond Would likely require an oversized system for highly emissive periods May cause ponding that could mobilize selenium into the food web for birds 	Potentially feasible for playa surface immediately adjacent to brine pond. Further research required to confirm effectiveness and refine.
Water-Efficient Vegetation	Establish vegetative cover to reduce surface wind velocity	<ul style="list-style-type: none"> Considerable infrastructure and operations effort required Proven feasible and effective at Owens Lake Water demand approx. 33% of seasonal surface wetting, 16% of open water 	Proven DCM, but high capital and ops cost, need to resolve performance specification issues and additional time for implementation
Seasonal Surface Wetting	Wet soil surface during dust season	<ul style="list-style-type: none"> High water demand Proven feasible and effective at Owens Lake playa May cause ponding that could mobilize selenium into the food web for birds 	Not considered further for ERS due to high water demand.
Regular Water Spreading	Periodic moistening with intervening drying of surface	<ul style="list-style-type: none"> Suitable for areas that need to be maintained free of vegetation and emissions, such as roadways May not be reliable on larger playa areas Considerable distribution facilities or trucking effort required 	Suitable for facilities such as roadways and berms.
Event-driven Irrigation	Wet soil quickly when needed	<ul style="list-style-type: none"> Uncertainty in scheduling irrigation to prevent wind erosion Oversized facilities required unless lead time is substantial High pressure head requirements likely to move water quickly over large areas Most problematic during high winds, when needed 	Not considered further for ERS. Further research required to confirm effectiveness and refine.

DCM	Basic Concept	Constraints, Requirements, Advantages, Effectiveness	Preliminary Finding for Large-scale Implementation at Salton Sea
Control of Traffic	Restrict unwanted traffic from exposed playa	<ul style="list-style-type: none"> Land ownership and jurisdictions must be respected and coordinated Legitimate public access must be allowed Large land areas involved Large potential benefit from relatively low cost Also applies to construction and operations traffic 	Essential for large areas of playa; need to maintain necessary access while limiting playa disturbance.
Moat and Row	Capture mobile sand in moats, break wind with row	<ul style="list-style-type: none"> Anecdotal observations that this has been effective at Owens Lake Moat maintenance (periodic cleanout or new moats required) 	High potential for widespread, cost-effective sand suppression; control efficiency probably moderate
Gravel Cover	Cover emissive soil with gravel	<ul style="list-style-type: none"> Unproven over large areas Supply and transportation issues Needs perimeter protection to avoid infilling Potential for subsidence May require underlying geotextile 	Not considered further for large areas of playa for ERS. Possible application for small areas.
Chemical Treatment and Stabilization Products	Increases adhesion between surface soil particles	<ul style="list-style-type: none"> Unproven over large areas Long-term performance and environmental issues Potential environmental issues (depends on material and environment) Frequent re-application can lead to high cost 	Not currently considered further for large areas of playa for ERS due to high maintenance cost. Potentially feasible for temporary control of small areas, especially for reduction in road/berm watering frequency.
Tillage	Roughen surface with heavy, primary tillage, capture sand	<ul style="list-style-type: none"> Temporary, must be repeated Increases emissions periodically (during actual tillage) 	Not currently considered for ERS due to elevated emissions during construction and maintenance.
Sand Fences	Capture mobile sand	<ul style="list-style-type: none"> Requires periodic removal and disposal of trapped sand Long-term maintenance difficult and expensive 	Not suitable for permanent control. Potentially feasible for temporary control of small areas.